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## ENVIRONMENT SURVEYS

Charles Calvert Room

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E73-10130

## FRACTURE MAPPING AND STRIP MINE INVENTORY IN THE MIDWEST BY USING ERTS-1 IMAGERY

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### ABSTRACT

Fracture patterns have been delineated on ERTS-1 imagery and aircraft color IR (1:120,000) and color (1:20,000) photography in southwestern Indiana and southeastern Illinois. Different sets of fractures are obvious on each different scale of imagery although the general (northeast-southwest and northwest-southeast) orientation is similar on all sets of imagery. In general, orientation of lineaments on the imagery correlates with measured directions in strip mines.

The advantage of repetitive and multiband coverage is illustrated by the fact that best displays of lineaments in different areas were on different bands and were taken at different times. In the Mattoon, Illinois, to Vincennes, Indiana, area the best imagery was band 5, taken October 1, 1972 (1070- 16050- 5); in the Danville, Illinois, to Terre Haute, Indiana, area, band 5, taken October 19, 1972 (1088- 16050- 5) and in the Bloomington to Evansville, Indiana, area, band 7, taken November 5, 1972 (1105- 15595- 7).

ERTS-1 imagery also was used to up-date the mapping of disturbed lands from strip mining for coal. In Warrick and Pike Counties, Indiana, 73 square miles of disturbed area had been mapped in 1968; 10 additional square miles that had been mined since 1968 were mapped on ERTS-1 imagery. Separate disturbed areas of less than five acres in size could not be mapped. However, for the larger areas additional increments of mining could be mapped annually, or quarterly, in less than an hour using ERTS imagery, but would require many man-weeks of ground survey.

E73-10131

Paper E 2

## DETERMINE UTILITY OF ERTS-1 TO DETECT & MONITOR AREA STRIP MINING & RECLAMATION

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### ABSTRACT

This experiment is concerned with the feasibility of ERTS-1 as a broad area survey monitor of the effect of strip mining on the environment. The direct effects are stripped or otherwise disturbed acreage and creation of bodies of standing water. There are natural and manmade recoveries of the disturbed areas that also require monitoring. Five counties in Southeastern Ohio are the selected test site and at least two mines are examined in the presentation by various means of remote sensing. Photographs from ground observation and a light plane depict the nature of stripping and emphasize the need for a view of area monitoring. Available aerial photography will be compared photographically and by digital processing to each band of ERTS-1 imagery. Disruption maps, which are defined as bare ground and standing water, are produced from both the aerial photography and the ERTS-1 Computer Compatible Tapes (CCT) and compared. Deviations due to the change in the strip mining and reclamation are present because the aerial photography was taken at least one year prior to the ERTS-1 over-flight. A reclamation map presents the recovered portion of the disruption as obtained over the years. Approximately 100% and 50% vegetation density maps will be available at the time of the presentation. Where completed, comparisons will be made between digitization and map plotting of strip mine disruption and reclamation in aerial photos to similar automatically produced thematic maps from ERTS-1 CCT. The results are expected to answer partially questions of ERTS-1 feasibility for monitoring strip-mining activity - both interpretative from its imagery and automatically from its CCT.

## THE USE OF ERTS-1 MSS DATA FOR MAPPING STRIP MINES AND ACID MINE DRAINAGE IN PENNSYLVANIA

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### ABSTRACT

Digital processing of ERTS-1 MSS data for areas around the west branch of the Susquehanna River permits identification of stripped areas including ones that are not discernible from visual analysis of ERTS imagery. Underflight data and ground-based observations are used for ground-truth and as a basis for designing more refined operators to make sub-classifications of stripped areas, particularly with regard to manifestations of acid mine drainage; because of associated diagnostic effects on vegetation, seasonal changes in classification criteria are being documented as repeated, cloud-free ERTS-1 coverage of the same area becomes available. Preliminary results indicate that ERTS data can be used to monitor not only the total extent of stripping in given areas but also the effectiveness of reclamation and pollution abatement procedures.

E 73-10133

## MONITORING VEGETATION COVER ON MINE DUMPS WITH ERTS-1 IMAGERY: SOME INITIAL RESULTS

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### ABSTRACT

One of the aftermaths of mining activities in South Africa has been the development and growth of mine tailings dumps. Environmental pollution from these dumps may be largely prevented by ensuring that a vegetative growth covers the entire dump and to this end the Chamber of Mines incurs annual expenses in excess of \$1,000,000. The growth or decline of this vegetative cover is monitored by both aerial photography and site visits.

ERTS-1 imagery is being used in an attempt to differentiate between mine dumps having varying degrees of vegetative cover. Two ERTS-1 images that cover part of the main mine dump area have been received to date, and have been analysed both qualitatively and quantitatively.

It has been found that the various mine dumps can be located and identified. Differences in vegetative cover can be seen and measured. Patterns of vegetative growth, some characteristic of particular dumps, can also be seen. It is therefore tentatively concluded that mine dumps can be differentiated with respect to their vegetative cover on these initial images. Subsequent imagery showing seasonal variations should facilitate the program.

It is anticipated that such ERTS-type imagery could ultimately be used to provide management data to the mining authorities with respect to the state of vegetative cover of all the major mine dumps in the Republic.

E73-10134

## REMOTE DETECTION OF AEROSOL POLLUTION BY ERTS

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### ABSTRACT

Meteorological, air quality and emission inventory ground truth have been used in the interpretation ERTS-1 MSS imagery of Eastern Virginia in order to survey existing particulate sources, find new emission sources, and study the characteristic geometries of smoke plumes down wind from large fossil fuel power plants. Area wide surveillance of metropolitan centers appears to be possible and techniques under development to be used to quantify ERTS imagery will be discussed with regard to production of isoplethic maps of particulates.

ERTS imagery defines plume geometries and this coupled to a numerical model and limited surface data should provide a three dimensional analysis of the concentrations down stream from plumes. Further it will be suggested that, in principle, by combined application of the ERTS derived data, the numerical model and special boundary layer measurements, the above can be solved backwards to arrive at techniques for monitoring stack emission rates. These applications of ERTS imagery can lead to significant extension of ground based air quality monitoring systems and provide input to future urban planning and abatement strategies.

E73-10135

## DETECTION, MAPPING AND ESTIMATION OF RATE OF SPREAD OF GRASS FIRES FROM SOUTHERN AFRICAN ERTS-1 IMAGERY

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### ABSTRACT

Sequentially obtained band 6 imagery from the Zambesi Basin of Southern Africa recorded substantial changes in patterns resulting from late dry-season grass fires. One example from northern Botswana, indicates that a fire consumed approximately 70 square miles of grassland over a 24-hour period. Another example from western Zambia indicates increased fire activity over a 19-day period. Other examples clearly define the area of widespread grass fires in Angola, Botswana, Rhodesia and Zambia.

Utilizing the fire patterns visible on the sequential portions of the imagery, and the time intervals involved, the rates of spread of the fires are estimated and compared with estimates derived from experimental test burning plots in Zambia and Canada. It is concluded that sequential ERTS-1 imagery, of the quality studied, clearly provides the information needed to detect and map grass fires and to monitor their rate of spread in this region during the late dry-season.

## ATLANTIC COASTAL WETLANDS MAPPING (MARYLAND, GEORGIA) USING ERTS-1 IMAGERY

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### ABSTRACT

Saline marshes and mangrove swamps play a major role in maintaining estuarine, coastal and ocean productivity. With increasing pressures on aquatic ecosystems for human food sources it is vitally important that remaining tidal wetlands in the U.S. and other areas of the world be preserved and managed in a way that benefits all. The first step in a preservation-management system is to map these areas to desired scales. Information required on the maps would at a minimum be general plant community composition, upper wetland boundary and areas significantly impacted by man related activities.

ERTS-1 data, reprocessed to bring out detail in wetlands and in three approximate scales (1/1,000,000, 1/125,000 and 1/24,000) have been analyzed in Chesapeake Bay, Maryland and Savannah, Georgia to determine usability for wetland mapping and ecological studies. The following have been determined from each of the scales.

- A. Scale 1/1,000,000 (as delivered from Goddard)
  - 1. Marsh-water interface and upper wetland boundary.
  - 2. Large plant communities, 100 M and above, including Spartina alterniflora, Spartina patens and Spartina cynosuroides; also Juncus roemerianus and Typha spp.
  - 3. Tree islands down to 160 meters and small streams to 16 M wide.
- B. Scale 1/125,000 (reprocessed to a negative and enlarged)
  - 1. Marsh-water interface and upper wetland boundary, and successional zones clearly shown.
  - 2. Smaller communities (less than 25 M in some cases) of the above listed species.
  - 3. Open (non-vegetated) ditches dug for drainage and agriculture.
- C. Scale 1/24,000
  - 1. All boundaries seen in other scales become blurred. It appears that this scale may be useful for some theme extractions such as upland, dry marsh, wet marsh and open water where placing of boundaries is not critical.



E 73-10137

## IDENTIFICATION OF COASTAL VEGETATION SPECIES IN ERTS-1 IMAGERY

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### ABSTRACT

Coastal vegetation species appearing in the ERTS-1 images taken of Delaware Bay on August 16, and October 10, 1972 (Observation ID. Nos. 1024-15073 and 1079-15133) have been correlated with ground truth vegetation maps, and imagery obtained from high altitude RB-57 and U-2 overflights. The vegetation maps of the entire Delaware Coast were prepared during the month of August and September, including the day of the August satellite overpass, using data collected on foot, in small boats, and from low altitude aircraft. Multi-spectral analysis of high altitude RB-57 and U-2 photographs indicated that five vegetation communities could be clearly discriminated from 60,000 feet altitude including, (1) salt marsh cord grass (Spartina alterniflora), (2) salt marsh hay and spike grass (Spartina patens and Distichlis spicata), (3) reed grass (Phragmites communis), (4) high tide bush and sea myrtle (Iva species and Baccharis halimifolia) and (5) a group of fresh water fowl. All of these species are shown in fifteen overlay maps, covering all of Delaware's wetlands prepared to match the USGS topographic map size of 1:24,000.

Major communities of (1) Spartina alterniflora, (2) Spartina patens and Distichlis spicata, and (3) Iva frutescens and Baccharis halimifolia can be distinguished from each other and from surrounding uplands in ERTS-1 scanner bands #6 and #7. Similarly, major impounded areas, built to attract water fowl, can be identified. Mosquito control drainage ditches and plant species such as Phragmites communis which naturally occur in small, dispersed patches are impossible to discriminate within the resolution capability of the ERTS-1 scanner. In disturbed marshes of northern Delaware Bay, Phragmites communis, does occupy large enough expanses of marsh to be detected. In summary, it appears from preliminary analysis that spectral discrimination capabilities of ERTS-1 imagery compare favorably with those of aerial infrared photography and that spatial resolution is the dominant factor limiting the potential for detailed vegetation mapping using ERTS-1 imagery.

E 73-10138

## APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT

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### ABSTRACT

ERTS-1 imagery is being used by the New Jersey Department of Environmental Protection (NJDEP) to develop information products that will assist the state in optimally managing its coastal resources and in allocating funding. Personal interviews have been conducted within the NJDEP and have led to the enumeration of significant problem areas within the coastal zone, and to the types of remote sensor derived information products that can be used in real-time decision making.

Initial analyses of imagery from several successive ERTS-1 orbits have shown the extent, predominant drift, and dispersion characteristics of waste disposal in coastal New Jersey waters. Imagery (MSS Bands 4 and 5) for several orbits, shows the New York Harbor tidal discharge extending as far south as Long Branch, New Jersey.

Within the bays, sounds, and thorofares behind the barrier islands in the southern New Jersey shore area, the increased reflectance of the turbid waters illustrates the effect of a large sewage effluent flow into these waters. As these waters are flushed with each tidal change, the turbid waters emanate out to the populous bathing beaches of this area.

Analysis of early ERTS-1 data indicates that the concept of repetitive looks at coastal circulation dynamics along the New Jersey shore will provide the kinds of information necessary for more effective decision making within the New Jersey Department of Environmental Protection.

E73-10139

## MONITORING OCEAN DUMPING WITH ERTS-1 DATA

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### ABSTRACT

Large volumes of municipal and industrial wastes are disposed of by means of dumping at sea. Disposal of wastes by barge dumping frequently produces surface films and waste fields whose fate and effects are not adequately defined. Frequently very large areas of the marine environment are affected.

An important factor in present and future programs for managing ocean disposal of wastes is the development of suitable monitoring systems. Described in this paper are the results of an analysis of ERTS-1 data for the New York Bight collected on August 16, 1972. Digital processing results are presented which show acid-iron wastes, sewage sludge, suspended solids, and major water mass boundary features in the study area. The potential of satellite remote sensing for monitoring large scale events such as ocean dumping is discussed.

E 73-10140

## ENVIRONMENTAL STUDY OF ERTS-1 IMAGERY: LAKE CHAMPLAIN AND VERMONT

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### ABSTRACT

Among the results obtained from ERTS-1 investigations at the University of Vermont, two groups of examples, which seem particularly relevant to resource management questions have been selected: (1) lake water quality and (2) land use. The limnological problems that show promise of monitoring through the use of ERTS data include industrial waste water discharge and turbidity changes. Land use is currently a vital issue in developing a state-wide land use plan, and land use mapping using ERTS data shows promise of providing new information for the continual process of updating the land inventory. In addition, ERTS imagery shows promise for providing information on vegetative cover, crops, and wetlands, which are closely related to land use, but which also relate to further resources research and application questions.

## WATER TURBIDITY DETECTION USING ERTS-1 IMAGERY

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### ABSTRACT

The major reservoirs in Kansas, as well as in other Great Plains states, are playing increasingly important roles in flood control, recreation, agriculture, and urban water supply. A method for acquiring timely low cost water quality data is needed to achieve optimum management of these fresh water resources. A progress report of an ERTS-1 study of reservoirs in Kansas will be presented. Two large federal reservoirs are sampled concurrently with each ERTS-1 overflight. Secchi disc and suspended load measurements show good qualitative correlations with tone variation on MSS bands. Digitized gray levels will be used to look for quantitative correlations between imagery and sample analyses.

E 73-10142

**DIGITAL ANALYSIS OF POTOMAC RIVER BASIN ERTS IMAGERY:  
SEDIMENTATION LEVELS AT THE POTOMAC-ANACOSTIA CONFLUENCE AND  
STRIP MINING IN ALLEGHENY COUNTY, MARYLAND**

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Washington, D. C.*

**ABSTRACT**

Two simple algorithms for classification of sedimentation levels in water and for delineation of active strip mines are in use as part of the development of a more general resource management information system. ERTS MSS CCT's are processed so that each pixel in each channel is geographically referenced and can be accessed individually during whole frame, multi-channel analysis or partial frame analysis.

The sedimentation analysis clearly separates classes representing the turbid Anacostia water, the less disturbed Potomac (really), and mud flats resulting from effluent of a major sewage treatment plant. Mud flats of organic or mineral origin are easily distinguished. Several classes of sedimentation are easily constructed.

Strip mines are classified as bright arcuate objects with unique reflectance and geometrical properties. In our imagery of Allegheny County, Maryland, the mines occur in rural areas where open fields are on the dissected Allegheny plateau, forests are more generally in stream channels below. The mines are cut into the horizontal contour of the valley slopes and are easily distinguished from their surroundings. Some field observations have been made, but we are not sure all mines were classified as such.

E73-10143

PRESENT STATUS OF REMOTE SENSING WITH ERTS IMAGE IN JAPAN

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NO ABSTRACT